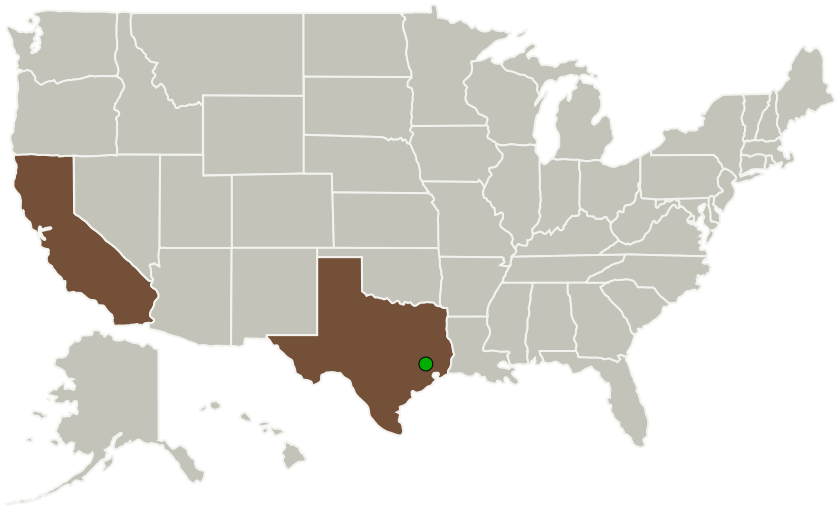
Nonflammable Crew Clothing Utilizing Phosphorus-Based Fire-Retardant Materials, Phase II

Completed Technology Project (2011 - 2013)

Project Introduction

For maintaining U.S. leadership in space exploration, there is an urgent need to develop nonflammable crew clothing with the requirements of comfort, ease of customization, durability and nontoxicity. The objective of this Phase II project is to continue the engineering development of heat and flame-resistant crew clothing (FRECLOTM) to satisfy NASA needs. FRECLO consists of InnoSense LLC (ISL) proprietary phosphorus-containing flame-retardant (FR) formulations permanently treated on synthetic, natural or blended fabrics as well as on the readymade garments. Phase I demonstrated the NASA use potential. Upon exposure to flame, FRECLO fabrics formed a carbonaceous char layer preventing further fire or heat-induced damage to the fabric. ISL's FR treatments are devoid of halogens, making the process environmentally-friendly and eliminating toxic byproducts during combustion. In Phase II, ISL will: (1) Optimize and scale-up FRECLO treatments, (2) Fine-tune FR formulations and application methods for performance optimization, (3) Perform rigorous evaluation of the treated fabrics, and (4) Evaluate off-gassing and biocompatibility of the treated fabrics. ISL has committed $100K as Phase II co-funding and has secured $300K as Phase III follow-on funding commitment from an industrial partner for successful technology transition. Large NASA prime contractors have strongly endorsed the FR materials.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Innosense, LLC	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB), Women-Owned Small Business (WOSB)	Torrance, California
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Project Transitions

June 2011: Project Start

September 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139288)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Innosense, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

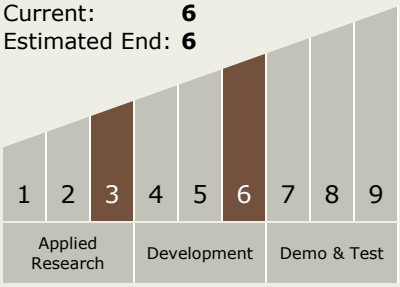
Carlos Torrez

Principal Investigator:

Rashmi Dalvi

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - TX06.4.3 Protective Clothing and Breathing

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System